USAID AND INTEGRATED PEST MANAGEMENT IN INDONESIA:

THE INVESTMENTS AND THE PAYOFFS

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Executive Summary

USAID Involvement in IPM in Indonesia

The Indonesian National IPM Training Program represents a paradigm shift for agricultural development Rather than the traditional top-down approach to agricultural research and extension efforts, the IPMTP institutionalizes a system whereby farmers provide the impetus for change This reorientation is driven by a focus on integrated crop management with farmers as the experts with respect to what goes on in their fields

IPM training in Indonesia was initiated in response to recurring pest outbreaks that were caused by excessive use of chemical insecticides In 1986, 57 of the most harmful pesticides were banned from use on rice and the IPM was announced as Government policy by the GOI USAID provided crucial support through the Agriculture and Rural Sector Support Program that funded preparatory activities and the establishment phase of the IPMTP that began in 1989 Using USAID budget support funds, the GOI contracted with FAO to provide technical assistance to the IPMTP The FAO project led the development of curricula and set the agenda for Farmer Field Schools The project was signed in May 1989 and opened initial training in July By January 1990 10 training centers were fully operational and 50,000 farmers were graduated from full season FFSs by June

Six provinces, accounting for about 70 percent of rice production, were selected for training Though initially training was concentrated in the most important producing areas, farmers, MOA workers, and local government officials in other areas also expressed interest in IPM training By 1992, when the establishment phase was complete, about 200,000 farmers in 8 provinces had received formal IPM training on rice through the IPMTP In addition to these, there was a significantly large expansion of the program through less formal means Farmers who had training were very enthusiastic about their experience Many who were not involved in training wished to be trained In many cases, farmers organized themselves and paid the expenses of training from their own resources It is difficult to estimate the number of farmers trained outside the formal program during the establishment phase, but IPMTP officials believe that 30,000 is a conservative estimate Furthermore about 2,450 vegetable farmers were trained in IPM for shallots, cabbage, or potato

The success of the establishment phase of the IPMTP is largely due to the FAO team that designed the training curriculum and directed its implementation The team consisted of a few key foreign experts to assist the core national IPM supporters and experts from Government and outside Government who understood the IPM concept and were committed to making IPM accessible to Indonesian farmers These IPM leaders were supported by a large and highly skilled team of young Indonesian professionals including planners, industrial engineers, agricultural scientists, field trainers, organizers, consumer advocates, and even the leaders of large people's organizations

Though the concept of the participatory mode of IPM training was known prior to the Indonesia program, it had never been implemented on such a scale The curriculum requires continuous fine-tuning, and during the establishment phase many of the details of the training design were developed by a steady process of experience and action research The FAO technical assistance team monitored training in all locations throughout the country and kept the process moving forward The FAO team provided the glue that held the disparate elements of the IPMTP together It has been suggested that without the FAO team at the center of the program from the outset, the Indonesia IPMTP would never have developed beyond a token effort in one or two locations and then withered away

The success of the establishment phase of the IPMTP was also due to several actions taken by the GOI and the assistance provided by international institutions including USAID The Government structure that was put in place through Bappenas and the key agencies of the MOA demonstrated the GOI's commitment to the program USAID funding was critical, coming at a time when Government resources were scarce and IPM farmer training was a new initiative FAO had the expertise and the dedication to the program that was required to bring the various components together into a workable unit

With the completion of the establishment phase of the IPMTP, the GOI entered into negotiations with the World Bank to expand the program The program funding would therefore change from USAID grant to World Bank loan The position of the FAO project became tenuous due to some individuals within the Government who wished to reduce, or eliminate FAO's role The new Minister of Planning concluded that the time was appropriate to transfer the IPMTP to the MOA Amid the confusion at the time, USAID took the position that the role of the FAO technical assistance team was critical and proposed to support that effort through ARSSP technical assistance funds The role of USAID in the policy dialogue related to the IPM project was instrumental USAID resources committed to the project were relatively small, but its position within the IPM program was important at the policy-making level USAID made it clear that it would support the FAO project and strongly recommended that it remain as an integral part of the IPMTP Ultimately, USAID designated US$7 15 in ARSSP grant to fund the FAO TA activity component of the IPMTP The grant was made to the World Bank, which assumed the responsibility to disburse funds and monitor project activity

The October 1997 WB supervision mission reported that the IPMTP was projected to fall short of the goals established at the beginning of the WB project, but substantial numbers of farmers had received, or were projected to receive training Nearly 600,000 farmers were expected to be trained through the IPMTP by the 1998 termination date Over 500 Pest Observers, 1,300 agricultural extension workers, and over 21,000 farmers were projected to be trained as IPM trainers Though these numbers reflect substantial progress towards the goal of establishing IPM as the national pest management strategy, impediments in the implementation of the project kept them lower than they could have been

An important outcome of the World Bank phase of the IPMTP is that FAO has led an emphasis on community-based IPM The radically refreshing goal of this effort is institutionalization of IPM at the farmer level, as opposed to the usual

bureaucratic assistance model This means that selected district, sub-district, or village level administrative units are targeted for IPM expansion The ultimate goal of community-based IPM is that communities – village, sub-district, or district – have an institutional structure in place for IPM training and technical support of IPM practices for all farmers By focusing on a community-based approach some synergies can be obtained to improve crop production And, management of the program is largely removed from the central Government This represents a departure from the usual mode of operation that deserves acclaim The goals of the community-based program are ambitious and aimed to benefit a heretofore weak constituency This program reaches to the core values of the farm community and proposes to establish a new form of community organization that will put the needs of the largest segment – farmers – at the highest level of priority

USAID's contribution to this program has been very important The FAO TA component of the project developed the concept of community IPM and provided guidance to its implementation USAID's commitment to Indonesia's IPM training effort has generated worldwide recognition Without this commitment, there is little doubt that IPM training in Indonesia would look very different from what it is today FAO, provided with the financial resources from USAID/Jakarta, has provided leadership in the development of the IPM training curriculum, and it has maintained an institutional presence in Indonesia through which it has exerted considerable influence over implementation of the program

From October 1990, USAID/Jakarta has supported work by World Education/Indonesia on projects operated in collaboration with local NGOs The focus of WEI activities has been IPM training, but other ancillary programs are also involved The WEI program has been funded at a level of $1 75 million and has been implemented in three phases All phases have the unifying theme of environmental management through enlightened use of pesticides and the collaboration of WEI with Indonesian NGOs While the WEI approach to IPM follows the same nonlinear experiential training model described above, their activities at the field level are independent of the national IPMTP WEI programs are focussed in specific communities and frequently deal with crops that are not part of the mainstream IPMTP WEI work falls under the same umbrella as the FAO effort in farmer led IPM system development and their work is complementary to and supportive of the IPMTP

WEI has played a key role in the development of IPM in Indonesia Up to 5,000 farmers per year have been trained through WEI and collaborator programs IPM trainers have also received advanced technical training under the program By focussing on key farm communities with established NGO structures in place, WEI has made significant contributions to those communities by strengthening the NGOs and improving the farmer IPM training program WEI has been able to facilitate some key innovations in training and implement related projects, such as marketing of IPM vegetables These activities ultimately promise to benefit not only the farmers directly affected, but also the broader communities of which they are a part

The research base for rice IPM was well established before training programs were begun Although technical advances have continued to be made, the most important development for rice was the training method By contrast, the

research base for vegetables and other non-rice food crops was not well developed, but many farmers also desired IPM training in these secondary crops USAID/Jakarta contracted Clemson University to provide technical assistance to address this problem The overall objective of the Clemson University project was to provide research and assistance that support and enhance the IPMTP for the development of adapted IPM systems for major insect pests of secondary crops produced in rice-based systems The two-year project was initiated in October 1992 It was subsequently extended through October 1997 at a total funding level of $2 3 million

During the five years of this project, Clemson maintained a senior research scientist with expertise in biocontrol of insect pests in Bogor The senior scientist led a research effort to develop IPM systems for soybean and selected key vegetable crops He was supported by consultancies of international experts to extend these efforts The project headquarters was housed in the Ministry of Agriculture's research facility in Bogor, West Java USAID/Jakarta provided funding to completely equip a laboratory to function as the center for IPM research

The primary responsibility of the Clemson Palawija Project was to develop IPM systems and provide input to the IPMTP The project operated under the supervision of the Research Committee of the IPMTP and all research efforts were conducted as collaborative efforts with various components of the IPMTP Training materials such as field exercises or field guides for IPM techniques were provided for use in FFSs

A University Development Linkages Project based in USAID/Washington provided funding for a collaborative project between Clemson University and the *Institut Pertanian Bogor* [Bogor Agricultural University] in October 1993 The project was scheduled for five years with total projected funding of $499,000 This project built upon the Palawija Project by establishing an official mechanism for collaboration between the two institutions and by providing funding for travel and to conduct research on topics of mutual interest Objectives of the project, in addition to conducting research, were to enhance the capability of IPB to function as a center of IPM expertise in Indonesia and to expand the international focus of Clemson University

Under USAID/Washington's program for Research Grants to Historically Black Colleges and Universities, South Carolina State University was awarded a $100,000 grant to conduct a study of the economic impact of IPM training for selected secondary crops in Indonesia Clemson University participated on the project under a sub-contract with SCSU The project was designed to evaluate the long-term effects of IPM training on cabbage and potato in North Sumatra, West Java, Central Java, and East Java Results confirmed that training, which in all cases was conducted in 1993, had positive benefits IPM trained farmers continue to employ practices learned through the training program

Lessons Learned

While much can be said of the details of the initiation and implementation of IPM training in Indonesia, scientific merit and farmer need for the program form the foundation of the IPMTP Post Green Revolution agricultural systems in the

tropics were, and for the most part still are, on an unsustainable course Excessive use of chemical pesticides distorts biological systems that react following normal evolutionary patterns to overcome the chemical perturbations Increased reliance on chemical pesticides ensues because the farmer, whose livelihood depends on protecting his crop, knows no alternative The "pesticide treadmill' is the result, and this is a system that cannot be sustained long into the future

The problems posed by the "pesticide treadmill" were recognized by key figures in the Government, USAID, and other international institutions USAID resources were made available at a critical moment to provide the catalyst necessary to get the training program started

The FAO project brought to the IPMTP a team of dedicated highly competent professionals who have provided the leadership needed to get the program started and to keep it running as efficiently as possible The core make-up of the FAO team has been in place since the beginning of the IPMTP They include a few key international experts and a large group of Indonesian nationals who have provided the driving force to keep the program on track and ensure that program resources are channeled to the farm level where they were intended

Cooperation with multilateral donors through arrangements such as the World Bank IPM project offers USAID a means to provide critical support to further its strategic objectives, and to leverage that support by joining the larger effort of the multilateral This arrangement also places USAID in a key role to exercise influence on the implementation of the total assistance package USAID needs to be aware of its opportunities and responsibilities with respect to these sorts of cooperative endeavors Often USAID may find that because of its well-trained technical staff and understanding of development goals, it may be in a position to exert a disproportionately large influence over project implementation

Farmer-trainers have demonstrated the capability to plan and organize research and training activities, and present these plans to government entities Given the limitations on local government discretion over use of funds, requests for funding of IPM training efforts must be compelling if they are to be successful Farmer-trainers have shown that they can develop detailed assessments of resources and needs of their areas and present these findings to local government officials with specific requests for financial and in-kind assistance The traditional linear model of development would not admit the leadership role assumed by farmers in the IPM model

Because of the localized nature of NGO programs, they can take risks that national programs cannot NGO training efforts are well suited to experimentation with new methodologies Because the number of trainers and trainees is limited, NGO programs can readily adapt new approaches that work, and dispense with approaches that do not work In this way the NGO community serves a valuable development function to discover and test training methods that can then be incorporated in the national program

Agricultural production systems are dynamic Crop ecology changes over time in ways that are not predictable The basis of IPM training is to equip farmers with the ability to recognize and adapt to the dynamic nature of their fields Research at all levels is necessary to respond to changes that occur

In the FFS farmers are exposed to simple experimentation techniques that they can apply in their own fields This type of research enables the farmer to adapt to the unique characteristics of his situation At a more generalized level, research that is widely applicable is necessary to cope with changing pest management and crop production patterns

The IPMTP has benefited from a variety of research efforts International efforts, much of it driven by the International Rice Research Institute, including participation of Indonesian scientists formed the research base of IPM systems Research specifically targeted to the Indonesian context is conducted by the Ministry of Agriculture and university research systems The FAO project and Clemson University have provided international experts to assist the IPMTP These efforts have led to major contributions, but much remains to be done

Recommendations

The scientific basis for IPM programs is transferable from one country to the next FAO has found that the participatory training approach is also transferable, transcending cultural differences Community based IPM projects are underway in several countries, though with varying degrees of success USAID should critically examine these efforts to determine the principal unifying themes reflecting successful approaches and constraints on the process of IPM adoption These will relate to all levels of the policy implementation spectrum

USAID goals of democratization and environmental management are clearly reflected by providing assistance to NGO efforts The participatory training model carries a strong democratization theme and sound environmental management is an obvious result of IPM adoption USAID priorities would be well served by facilitating the exposure of NGOs in other countries, or international NGOs with programs in other countries, to Indonesia and the various NGO activities that have taken place there

IPM training as it is conducted in Indonesia emanates from a new view of agricultural development The IPM paradigm is not immediately understood or embraced by policy leaders or program implementers For that reason, it is important for potential IPM advocates from other countries to have a long-term exposure to the functioning of the IPM paradigm so they can carry the correct message back to their homes

The science of IPM is a dynamic field and many of the crop management issues that IPM scientists confront are important internationally Facilitating interaction among crop scientists will enhance development of the science of IPM Indonesia has dedicated resources to IPM research under the IPMTP and through assistance programs, including USAID's, that reinforce the IPMTP Thus, Indonesia is an excellent focal point for IPM conferencing among regional experts USAID should take advantage of the research capital that has been developed in Indonesia, and of the potential contributions that may come from regional collaborators, by supporting forums that bring them together

The Clemson University projects demonstrate that international partnerships provide a basis for high quality support to the IPMTP The resources provided

through these research-oriented projects allow scientists to respond effectively to key problems identified by field IPM support staff Responses can be in the form of field tests of various IPM alternatives, or workshops or other short educational programs to bring field staff up to speed on approaches to new problems Whatever the specific issue or appropriate response, the key is that there is minimum delay between problem identification and response This type of effort is distinct from projects operated through the established research structure Allocation of research funds and priority setting are not constrained by an institutional structure formed in line with the linear paradigm The result of this type of program is a synergistic combination of research talents that bring international experience and local familiarity to bear on critical problems quickly and efficiently

USAID AND INTEGRATED PEST MANAGEMENT IN INDONESIA THE INVESTMENTS AND THE PAYOFFS

I USAID'S CONTRIBUTION TO THE INITIATION, IMPLEMENTATION, AND INSTITUTIONALIZATION OF IPM IN INDONESIA

Introduction

IPM in the Indonesian Context

The Integrated Pest Management (IPM) program in Indonesia must be understood within the context of the development paradigm that it fits This paradigm is described in the comments of Dr Niels Roling found in Appendices 6 and 7 of the Aide Memoire of the World Bank Mid-Term Review Mission, September 25 – October 13, 1995 The point to be made is that the IPM model differs substantially from the "linear paradigm" that characterizes traditional agricultural development policy

The linear paradigm is a top-down approach where research is conducted by technical experts and passed through a system of rigid institutional channels to recipients at the field level Typically technology is embodied in a package of practices that farmers are taught to employ, including selection of cultivars, prescribed rates of fertilization, and pest management tactics based on clear-cut decision criteria The packages are implemented on a broad geographic scale that is generally inflexible with respect to local conditions The top-down approach does not allow for accommodation to unique characteristics of individual farms Farmers are encouraged, often coerced, to adopt these packages through formalized government programs providing access to credit, production inputs, and extension services The role of the farmer as receiver of technology that is provided to him through a hierarchy of government agencies is part and parcel of the linear model

Indonesia has experienced considerable success with the linear model Green Revolution technology enabled Indonesia to move from a situation of widespread hunger to attain the capacity to feed its people, and ultimately become self sufficient in rice production This is a feat of considerable magnitude for a country of some 200 million people, where rice is the basic foodstuff of virtually the entire population

However successful the linear paradigm was in facilitating this achievement, it has serious drawbacks

Green Revolution technology packages enabled a rapid rise in yields But, these yield increases have plateaued, and because of the lack of local specificity, resource allocations guided by global recommendations were not optimal given the diversity of local conditions The next step in the development of agricultural production capacity is to raise efficiency of resource use This step requires a change in the paradigm for government assistance to producers

The IPM model, as designed and implemented in the Indonesia IPM Training Program (IPMTP), represents a distinct paradigm shift Farmers, rather than being receivers of technology, are the innovators Support from the scientific community continues to be an integral component of the development process, but scientists act in

a support role rather than as donors to the farmer community Innovation is demand driven instead of supply driven as in the linear model

The IPM model embodies a network of social organization with farmers at the core Training is designed to provide farmers with the knowledge base necessary to make decisions for themselves However, the IPM model does not seek to isolate farmers or make them independent of support services They are taught to organize and take group action when necessary For example, certain pest management strategies only work if farmers in proximity to one another coordinate their crop management activities In the IPM model, farmers are empowered to make decisions based on their observations of the conditions peculiar to their fields But, they are also empowered to recognize the need for assistance from government authorities, or others who are in a position to provide needed aid, and to be proactive in soliciting assistance The empowerment of farmers and their role as the key decision-makers are at the heart of the IPM model Thus, the IPM paradigm is one of human resource development Technological innovation, economic, and social impacts ensue from the process of farmers taking a leadership role This nonlinear paradigm is driven from the farm level

This paradigm shift builds upon basic human values Farmers take control of their livelihoods in a way that was not possible before Technology and support services are in place to serve the beneficiaries, not to dictate to them

The change in the paradigm for agricultural development that IPM represents in Indonesia has not been ubiquitous and it has not been fully implemented as Government policy However, major steps have been taken in support of the paradigm, and evidence derived from the experience confirms that the IPM model leads to positive results USAID support for IPM in Indonesia came at a critical time and has enabled the Government of Indonesia (GOI) to take bold steps towards implementing the new paradigm

USAID Support

Since 1987, USAID support to the Indonesia IPM program has taken several forms Initially USAID support was in the form of a grant to the Government to support a broad array of policy initiatives including the encouragement of IPM as a national pest management strategy In 1989 a program to train smallholder rice farmers using a field based training approach was begun The GOI contracted the United Nations Food and Agriculture Organization (FAO) through its Intercountry Programme for Integrated Pest Management in Rice-Based Cropping Systems in South and Southeast Asia (ICP) to take the lead in the design and implementation of the establishment phase USAID grant funds were used to finance the contract with the FAO and to fund implementation activities through the Government budget The establishment phase terminated in 1992

The GOI obtained a $32 million loan (Loan 3586-IND) from the World Bank (WB) in March 1993 for the purpose of supporting the national IPM Training

Program, and to expand it to cover the 12 major rice producing provinces USAID/Indonesia provided grant funds of $7 15 million to be administered through the WB in support of the FAO technical assistance component of the Program The GOI is contributing $14 million, so the total project cost is $53 million Due to bureaucratic delays the actual startup of the expanded phase of the IPMTP was June 1994 The USAID grant and the World Bank loan project are scheduled to terminate in May 1998 Plans are in place to reallocate some $5 million of unspent WB loan funds for agricultural extension to the IPMTP through 1999 However, USAID/Indonesia is not currently planning further involvement with the IPMTP beyond May 1998

World Education/Indonesia (WEI) provides technical assistance and backstopping services for a network of local NGOs in Indonesia who work in the field of IPM and related farmer-oriented activities From October 1990 USAID has provided funding of $1 75 million to support this work WEI, through the local NGOs with which they work, targets key production areas and crops for IPM training in the participatory mode Additional activities include work with farmer groups to market products based on their desirability as a healthier alternative to products with the high levels of pesticide residues commonly found in the market

Recognizing the complex technical issues that predominate in vegetables and other non-rice crops integrated into rice-based cropping systems, USAID/Indonesia contracted with Clemson University to provide scientific backstopping for secondary crops The contract with Clemson, for $2 3 million, ran from October 1992 through October 1997 It supported a full-time scientist and assistance from several international experts to develop IPM systems and training materials to be used by the IPMTP

A second USAID activity with Clemson University is funded under the USAID/Washington University Development Linkages Project Clemson and the *Institut Pertanian Bogor* (IPB) [Bogor Agricultural University], located in Bogor, West Java, are provided funds to support collaborative research and education programs related to IPM on secondary food crops in Indonesia This project, that began in October 1993 and is scheduled to terminate in October 1998 with planned funding of $499,000, enables Clemson and IPB to collaborate on field research projects, hold workshops on specific IPM topics, and produce training materials for the IPMTP

Finally, South Carolina State University was given a grant under USAID/Washington's Research Grants Program for Historically Black Colleges and Universities This two-year grant, from October 1995 to October 1997, for $100,000 supported a study of economic impact of IPM for selected secondary crops in Indonesia Clemson University and IPB were also collaborators on this project Graduate students from the three universities worked together to gather and analyze data on farm practices of cabbage and potato growers from three provinces

Agriculture and Rural Sector Support Program (1987-93)

The Agriculture and Rural Sector Support Program (ARSSP) was initiated in August 1987 as a means to provide budget support to the GOI at a time when domestic resources were strained because of a precipitous fall in the world price of oil, the major source of foreign exchange The ARSSP was a broad-based program aimed

at supporting a set of policy initiatives agreed between USAID and the GOI The policy objectives of the program covered a range of issues including IPM

The Indonesian budgeting process involves two parts The "routine' budget administered through the Ministry of Finance covers the recurring expenses of the national Government The "development" budget administered through the National Development Planning Agency (Bappenas) covers project implementation expenses Since the routine budget receives higher priority, development initiatives suffer the most in times of fiscal strain The ARSSP was used to support an array of development activities that otherwise would not have been fully funded, or funded at all The GOI had authority to apply the specific expenditure of the funds provided under the ARSSP Accountability to USAID for the use of the funds did not relate to specific expenditures, but to satisfactory progress towards policy objectives Funds were used to support activities of the Agency for Research and Development and the Directorate General for Food Crops in the Ministry of Agriculture (MOA), the Directorate General of Taxation, the Directorate General of Monetary Affairs, and the Board for Finance, Credit, and Balance of Payments Analysis in the Ministry of Finance (MOF), and the Central Bureau of Statistics and IPM under the National Development Planning Agency

The development goal of the program was a negotiated set of policy objectives that the GOI agreed to undertake Success of the program therefore was meant to be judged on the basis of progress made towards achievement of the policy objectives However, disbursements of program funds were not conditional on specific accomplishments As long as subjectively assessed progress was made towards the policy objectives, the budget support activity could proceed

The key policy objectives of the ARSSP that related to IPM were 1- to reduce pesticide subsidies and 2- to implement the IPM program for rice and extend it to include other crops Pesticide subsidies were eliminated almost coincident with the original signing of the ARSSP agreement Implementation of the IPM program has progressed steadily since then

The ARSSP represented a departure for USAID at the time in terms of the approach to development assistance Program, as opposed to project, funding was applied Under the program approach, the GOI was given all budgeting and expenditure responsibility Amounts of funding going to each government agency were negotiated annually with Bappenas and the MOF and disbursements were made periodically to a special account held in the Bank Indonesia for this purpose When the account balance was sufficiently low that new disbursements were warranted, funds were transferred Project management of ARSSP supported activities was the responsibility of the relevant GOI agency Under this arrangement, ARSSP funds were designated for Bappenas to use to operate the IPMTP

A small amount of the ARSSP budget was designated for technical assistance to be managed by USAID/Indonesia in a project mode This component of the Program was designed to provide a mechanism to respond to short-term needs for specific technical assistance to support policy objectives For example, ARSSP TA supported technical advisors to the Ministries of Agriculture and Trade, the Bank Indonesia, and the Jakarta Stock Exchange

The ARSSP budget support program was in place from 1987 to 1992 During

that period a total of about $60 million was granted to the GOI in the form of budget support Of that total about $16 million was for the support of the National IPM Training Program From 1993 to the termination of the ARSSP in 1998, the Program was entirely for technical assistance, of which $7 15 million was designated to fund the FAO TA support to the IPMTP

ARSSP Budget Support for IPM

Background

In 1986 the GOI responded to a recurring problem of severe outbreaks of the rice insect pest, brown planthopper, that drastically reduced rice production A Presidential Decree was promulgated that eliminated subsidies on all pesticides and banned 57 of the most toxic pesticides from use on rice This step was taken because scientific evidence from the International Rice Research Institute and from national researchers showed that the brown planthopper was a pest that was induced by heavy spraying of chemical insecticides Because of the widespread application of chemical pesticides that were part of technology packages that farmers were encouraged to use, the natural ecology of rice fields was thrown out of balance by killing off the natural enemies of rice pests The brown planthopper was, in effect, a pest that was caused by pesticides Recognizing the deleterious effects of chemical insecticides, the Presidential Decree also stated that farmers would be encouraged to adopt IPM as their pest control strategy

Prior to 1986, although there was a small IPM program under the Ministry of Agriculture, it was not a major factor in the national pest control picture Green Revolution technology that significantly impacted Indonesia's ability to obtain greater rice yields was based on technological inputs including improved varieties and fertilizer that were incorporated in a program of water management and credit to farmers to obtain the necessary inputs Though chemical pesticides were not a part of the technological requirements of the Green Revolution systems, Government programs included pesticides in their extension packages Farmers obtained substantial yield gains by using these packages Indonesian rice production rose and imports of rice fell considerably

In the mid-1970s and again in the early 1980s pest outbreaks devastated rice production, and the Government sought a solution to the problem Researchers at the International Rice Research Institute (IRRI) had determined that brown planthopper outbreaks were caused by excessive chemical insecticide applications on rice Independently, scientists at universities and the Ministry of Agriculture research system in Indonesia found the same to be true This message was carried to top Government officials through several channels Though USAID was not involved at the early stages, other international agencies were The Harvard Institute for International Development (HIID) had a team of advisors working through the Ministry of Finance, one of whom, Dr Wolfgang Linser, advised on agriculture and environmental issues The ICP, led by Dr Peter Kenmore, was actively involved throughout the region in an attempt to discourage indiscriminate pesticide use

National experts were integrated into the international network of proponents of IPM Notable among these national experts was Dr I N Oka, an MOA scientist and member of the IRRI board of directors Formal and informal discussions of the topic were held in various settings At one point a group of national and international plant protection scientists met with President Suharto to discuss the issue The Presidential Decree ensued, and a serious effort to encourage IPM was begun This is the point at which USAID entered the picture

At the outset there were some delicate political issues that had to be dealt with IPM was one of many issues on the table in the policy discussions that took place as the ARSSP was being initially negotiated At the same time the Government had to come to grips with some internal issues that surrounded the pesticide issue There were high level officials within the MOA who had personal financial interests in pesticide companies Some of these were in key positions as regards the logical administrative home for an IPM training program Minister Sumarlin, who at the time was the head of Bappenas, recognized this problem He was in favor of a serious IPM effort and decided that the establishment phase would be administered through Bappenas instead of the MOA The IPM case was the one development case study carried and presented by Mr Sumarlin at the meeting of international donors to Indonesia in 1988 Enter ARSSP

By housing the program in Bappenas the Government was able to establish an administrative structure that was not complicated by competing interests and that had IPM training as its sole mandate This reflected a significant departure from the usual functioning of the Government in that Bappenas is not an implementing agency Bappenas' responsibilities are to manage the development program across the Government hierarchy, but to leave project implementation to the line ministries In the case of IPM training, Bappenas took on the implementing role with the understanding that after the establishment phase was over and supporting policy and personnel were in place, the program would be transferred to the MOA

Under the ARSSP funds were allocated to Bappenas for the purpose of supporting IPM These funds were used to effect the necessary Government realignment of responsibilities and commitments at the field level, and, most importantly, to support the GOI contract with the FAO to develop training curricula and to manage the establishment phase The FAO project in Indonesia was established as a distinct unit, but received and continues to receive support from the ICP In the beginning of the establishment phase, the ICP assisted in recruiting an experienced team of national and international experts to work on the Indonesia program The ICP also provides backstopping through its accrued experience in other countries The contract was signed in 1989 and the IPMTP was effectively begun at that time

Two critical issues should be highlighted at this point First, the bold step on the part of the GOI to make a serious effort to train farmers in IPM was not universally applauded within the Government The top officials who put the program in motion were not totally supported by a loyal team of IPM advocates Therefore, the decision to house the establishment phase of the IPMTP in Bappenas represented a commitment from the top that IPM would be a priority issue, and protected the program from possible sabotage by mid-level bureaucrats with conflicting vested interests

The second critical event was the signing of the FAO contract USAID provided the funds, but FAO had the expertise and the GOI had the wisdom to put those together The concept of experiential training as applied to pest management was crucial to the success of the proposed program Through the ICP, FAO had the expertise and the experience of working in the field that was needed to underpin the massive training effort that the GOI envisioned Furthermore, FAO was not encumbered by the political obligations that would have been true of an agency from within the government structure

The FAO provided technical assistance for curriculum development and organization from the beginning of the training effort But, before the FAO contract was signed USAID contracted Dr Kevin Gallagher, under the ARSSP technical assistance component, to prepare curricula for training of trainers Dr Gallagher subsequently joined the FAO project His work in anticipation of the beginning of the establishment phase saved time that otherwise would have been required for preparation Given that IPM training requires following a crop through an entire growing season, the time saved in preparation significantly reduced the time required to complete a training cycle To establish the training program trainers first had to be trained, so the contribution of Dr Gallagher under the ARSSP TA capability played a key role in the smooth take-off of the establishment phase

The project was signed in May of 1989 and opened initial training in July By January 1990 10 training centers were fully operational and 50,000 farmers were graduated from full season Farmer Field Schools (FFS) by June

Implementation of the Establishment phase

The establishment phase of the IPMTP required an effort to create a new institution within the existing GOI structure The training itself had ambitious goals that required an extensive personnel network in the selected rice-bowl regions chosen for training sites Trainers and field level support personnel were selected from the Government Plant Protection and Extension services The MOA structure for the areas selected for farmer training consisted of one Pest Observer, from the Plant Protection agency, in each sub-district supported by an agricultural extension worker, from the Extension agency, in each village The roles of the trainers were thus radically changed from carriers of instructions from the center, as in the linear model, to facilitators in the mode of the IPM model To effect this change, the trainers were trained according to the IPM principles and training methods that were developed by the FAO team

Participation is the key word of the IPM training model Training is not conducted in a classroom mode The trainer's role is to facilitate learning by the farmer in a manner that reveals the principles underlying the biological systems inherent in fields in such a way that the farmer discovers those principles for himself This is achieved through a series of activities conducted in the field and in the meeting room

Training is conducted in small groups to facilitate interaction among farmers A typical training session would have 25 farmers, usually members of an established farmer group organized on a neighborhood basis or operators of contiguous fields, who

live sufficiently close to one another that transportation to training would not deter attendance The training site would include a shaded sheltered meeting site with a nearby field of about 1000m^2 rented for the crop season Training takes place from the beginning through the end of the season, with the group meeting on one day each week for four to five hours Farmers were paid a small compensation for work time lost due to attending training sessions, and snacks were provided by the program

Training activities are divided between the field and the meeting room In the field farmers observe the dynamics of the insect ecology as it changes through the season and as it is affected by perturbations caused by outside forces such as chemical sprays Simple experiments are conducted to demonstrate the impacts of various cultural practices including pest management The ultimate goal of IPM training is to "grow a healthy crop" To achieve that goal the farmer must understand not only pest management problems, but also other practices that affect crop production such as fertilization, variety selection, water management, and so on Field activities are designed to demonstrate crop management options, and more importantly, to teach farmers to conduct simple research in their own fields By following the progress of the crop through the entire season, farmers can learn important lessons about how the ecology of the field changes over time, and about how plants respond to shocks such as defoliation and the resulting impacts on yield

The myriad factors that can come into play in the course of producing a crop cannot be completely covered in a single season training effort Therefore, training focuses on enabling farmers to test alternative approaches and to conduct their own experiments after training is completed Farmers are encouraged to question and to test alternatives to discover the best alternatives for their situation Crop production by the IPM model requires that farmers observe their fields and seek the optimum set of practices that are appropriate for their fields In terms of pest management, that means that chemical pesticides will be the action of last resort, only to be applied if the ecological balance between pests and natural enemies has been significantly disturbed in favor of the pests This will occur very rarely Other factors, such as optimum fertilization, will vary depending on location and soil characteristics in a given field so individual testing of alternative rates will enhance the farmer's ability to grow a healthy crop

The training approach is based on a process of group activities Farmers conduct field observations, agro-ecosystem analysis, and experiments in small groups of four or five Full group discussions compare results and debate outcomes and decisions These small groups are purposely organized to be of a size that will encourage participation of all members The groups observe the condition of the crop and the ecology of the field Agro-ecosystem diagrams are prepared on newsprint to document these observations for presentation to the full group and for reference later By the end of the training season, the collection of diagrams provides an effective tool to review the crop production process and the ecological changes that occurred during the season

Group activities have an underlying purpose that is at the heart of the IPM model By working together and discussing mutual concerns, farmers learn the elements of group dynamics Training activities are designed to elicit active participation of all members of the group These activities are fundamental elements

of the underlying training philosophy to empower farmers to become the experts and to apply their expertise to achieve personal goals Often that expertise will require cooperation with farmer colleagues to solicit institutional support from government offices For example, funding may be needed to support a training or research project that will benefit several farmers in a given area Farmers may need the support of extension or research experts for a particular problem Farmers may wish to coordinate some of their crop management activities to gain maximum impact, such as rat control Group action is warranted for these sorts of activities, but the motivation for group action must originate with the farmers who will be the major beneficiaries Training that focuses on group empowerment leaves the trained farmers with the confidence and ability to cope with the numerous crop management problems they will encounter after training is completed

Thus, when training is complete farmers who have completed a full season Farmer Field School (FFS) should understand the ecology of their fields, including the relationship of pests and natural enemies They should understand that most frequently natural enemies keep populations of pest species in check Only when pest-natural enemy populations are seriously out of balance should the use of chemical pesticides be considered

Training prepares farmers to be the experts in their fields That includes the ability to recognize new problems and to seek assistance or organize cooperative action to deal with them Empowerment of farmers to manage their affairs and to confidently deal with commercial and government influences is the essence of the IPM training model

This training model was developed and implemented during the establishment phase of the IPMTP The participatory model was known in concept prior to the beginning of the program, but implementation required a continuous process of modification and fine-tuning Indonesia provided the proving ground for the IPM training model Success of the model was demonstrated by the positive response on the part of the farmers who were trained, other farmers who expressed their desire to obtain training, and government officials who recognized the benefits of IPM IPM training in Indonesia rapidly became the example for other countries to follow

Results of the Establishment phase

Training sites were selected because of their importance to rice production in Indonesia Six provinces, accounting for about 70 percent of rice production, were selected for training [1] The major focus of training was on rice, however, training was also conducted in some places for soybean and vegetables Soybean is a crop that is frequently planted in rotation with rice during the dry season when adequate water for rice production is not available Indonesia is a large importer of soybean, mostly as feed for the rapidly growing livestock industry The GOI is actively promoting expansion of soybean production As with other crops, soybean farmers generally use excessive chemical insecticides, so IPM for soybean can play a significant role in

1 East Java, Central Java Yogyakarta West Java North Sumatra and South Sulawesi

improving crop production practices

Vegetables are less extensively planted than rice or soybean, but the over-use of chemicals on vegetables is particularly acute Spraying of mixtures of chemical pesticides as often as two to three times per week is not uncommon for some vegetables IPM alternatives to these practices can reduce pesticide use dramatically Therefore, the program undertook to train farmers who plant vegetables in rotations with rice, and certain full time vegetable farmers in selected key producing areas

Though initially training was concentrated in the most important producing areas, farmers, MOA workers, and local government officials in other areas also expressed interest in IPM training By 1992, when the establishment phase was complete, about 200,000 farmers in 8 provinces had received formal IPM training on rice through the IPMTP In addition to these, there was a significantly large expansion of the program through less formal means Farmers who had training were very enthusiastic about their experience Many who were not involved in training wished to be trained In many cases, farmers organized themselves and paid the expenses of training from their own resources It is difficult to estimate the number of farmers trained outside the formal program during the establishment phase, but IPMTP officials believe that 30,000 is a conservative estimate Furthermore about 2,450 vegetable farmers were trained in IPM for shallots, cabbage, or potato

The institutionalization of the IPMTP within the Government structure is evidenced by the number of Pest Observers and agricultural extension workers, from the MOA Plant Protection and Extension agencies, whose jobs were changed to include IPM training By 1992, a cadre of 2,160 Pest Observers, who received three seasons of IPM training, and 7,555 agricultural extension workers, who received IPM training and worked full season with field schools in the local areas, were in place to provide IPM training in rice, soybean, and vegetables They were supported by 330 Field Leaders who had received three seasons of IPM training plus university training Twelve IPM training centers were fully established Thus, the MOA hierarchy came to include a core of IPM advocates and training infrastructure to expand the program

It should be noted that this cadre of trainers developed into strong advocates of IPM Previously their jobs were defined in the linear mode of passing information from the field to the center for analysis and then back to the field as broad directives As IPM trainers these MOA representatives became more closely involved with what was really happening at the farm level, and they possessed knowledge of a system of farm practices that would substantially improve the conditions of their farmer clientele This group carries the responsibility for sustaining the IPM approach and providing farmers with a line of communication to additional services

The success of the establishment phase of the IPMTP is largely due to the FAO team that designed the training curriculum and directed its implementation The team consisted of a few key foreign experts to assist the core national IPM supporters and experts from Government and outside Government who understood the IPM concept and were committed to making IPM accessible to Indonesian farmers These IPM leaders were supported by a large and highly skilled team of young Indonesian professionals including planners, industrial engineers, agricultural scientists, field trainers, organizers, consumer advocates, and even the leaders of large people's organizations

Though the concept of the participatory mode of IPM training was known prior to the Indonesia program, it had never been implemented on such a scale The curriculum requires continuous fine-tuning, and during the establishment phase many of the details of the training design were developed by a steady process of experience and action research The FAO technical assistance team monitored training in all locations throughout the country and kept the process moving forward The FAO team provided the glue that held the disparate elements of the IPMTP together It has been suggested that without the FAO team at the center of the program from the outset, the Indonesia IPMTP would never have developed beyond a token effort in one or two locations and then withered away

The success of the establishment phase of the IPMTP was also due to several actions taken by the GOI and the assistance provided by international institutions including USAID The Government structure that was put in place through Bappenas and the key agencies of the MOA demonstrated the GOI's commitment to the program USAID funding was critical, coming at a time when Government resources were scarce and IPM farmer training was a new initiative FAO had the expertise and the dedication to the program that was required to bring the various components together into a workable unit

During the establishment phase of the program IPM principles were shown to be effective and clearly superior to the chemical-based systems they replace Farmers who were introduced to IPM eagerly embraced the new approach However, there remained detractors who were unconvinced by the IPM model Despite occasional bureaucratic intransigencies, personal conflicts of interest, and attacks from proponents of the linear model, the IPM approach survived the establishment phase The evidence from the establishment phase demonstrates the benefits of IPM Detractors argue over details, but the Indonesian IPMTP developed from a policy-maker's vision to a worldwide example for agricultural development

The 1992-94 Hiatus

In October 1992 the ARSSP budget support activity terminated The fiscal stress that motivated the budget support had eased, so the program was changed The ARSSP was renewed and additional money added to the program, but the focus was shifted from budget support to technical assistance The underlying goal of the program continued to be policy reform, but the mechanism of ARSSP funding was changed The program was renewed in a more project-oriented vein Specific technical assistance activities were identified and funded under ARSSP to enhance the GOI s ability to achieve policy objectives IPM was one activity that was included under the new ARSSP

With the completion of the establishment phase of the IPMTP, the GOI entered into negotiations with the World Bank to expand the program The program funding would therefore change from USAID grant to World Bank loan The goals of the proposed program were ambitious – to train farmers, MOA trainers, and farmer trainers, and to support them by establishing research and training infrastructure, and regulatory and policy assistance

After the USAID support was terminated in 1992, the GOI used existing

unspent WB loan funds from an agricultural extension project to continue IPM training on a limited scale When GOI funding of the FAO project ceased, the project drastically cut back its activity but maintained a presence with funds from the FAO ICP

A shuffling of positions within Government occurred after the 1993 elections and many of the key officials involved in the IPMTP moved into different roles The position of the FAO project became tenuous due to some individuals within the Government who wished to reduce, or eliminate FAO s role The new Minister of Planning concluded that the time was appropriate to transfer the IPMTP to the MOA

Amid the confusion at the time, USAID took the position that the role of the FAO technical assistance team was critical and proposed to support that effort through ARSSP technical assistance funds The role of USAID in the policy dialogue related to the IPM project was instrumental USAID resources committed to the project were relatively small, but its position within the IPM program was important at the policy-making level USAID made it clear that it would support the FAO project and strongly recommended that it remain as an integral part of the IPMTP Ultimately, USAID designated US$7 15 in ARSSP grant to fund the FAO TA activity component of the IPMTP The grant was made to the World Bank, which assumed the responsibility to disburse funds and monitor project activity The grant terminated in April 1998

Though the process to develop the WB loan program began in late 1991 and early 1992, funds were not made available until June 1994

USAID Support of FAO Technical Assistance

Design of the World Bank Project

The new project was designed to expand the existing IPMTP to encompass 12 provinces comprising 93 percent of Indonesia rice production Specific human resource development objectives of the WB project are to train 520 Pest Observers and 1,100 Agricultural extension workers as IPM trainers, to provide long-term training of Agricultural extension workers at selected universities offering IPM curricula, to train 630,000 farmers directly through the IPMTP, 25,000 FFS alumni as farmer trainers, and an additional 250,000 farmers by the farmer trainers, to train 280 IPMTP staff in agro-ecosystem analysis, and to strengthen the IPMTP management information system provide and promotion activities for dissemination of IPM information These objectives are supported by special studies and field investigations Studies of occupational health of pesticide applicators and habitat studies of pests and natural enemies in different agro-ecological systems are specifically mandated Action Research Facilities (ARF) are to be established in key production areas for rapid development of practical control methods A more formal research agenda is supported through the project by providing competitive grants to university and MOA scientists Policy and regulatory programs are strengthened by assistance to the Pesticides Commission and the system for monitoring and regulation of pesticide manufacture and labeling

The FAO TA role in the project is similar that performed during the

establishment phase FAO provides the technical backstopping to training including curriculum design and training implementation Other activities include technical expertise and guidance for developing management information systems and area planning, conducting ecological and health impact studies, and development of biological control systems for use in IPM training Though it is not explicitly written into the project design, the FAO TA plays an additional role bringing focus to the project and defending the practice of field-driven implementation The FAO project office in Jakarta acts as a clearing-house for project activities FAO backstops all technical areas, designs programs, supports operational and financial planning, while doing the primary job of supporting farmer based initiatives and the field leader network The FAO team defends the IPM training model against competing interests, and leads the development of the community-based expansion of the program This role of FAO is recognized as critical to the successes that have been achieved by the WB project USAID had the foresight to anticipate the need for the FAO component, the financial means to support it, and the resolve to argue persuasively that FAO TA was essential

In its design, the WB expanded IPMTP is a logical extension of the establishment phase It builds on the successes of the establishment phase and seeks to grow the program to cover nearly all the rice producing regions of the country Secondary crops are also included in the expanded program through training for *palawija*[2] and vegetables To sustain the planned expansion of training, the support structure within the Government is also designed to grow Transfer of the GOI home for the project to the Ministry of Agriculture meant that some significant bureaucratic rearrangements had to take place to accommodate the new phase of the project Thus, though the main thrust of the program – farmer training – built upon a solid design and ample field experience, there were some important new changes taking place as well GOI management was moved from Bappenas to the MOA and the funding source was changed from USAID grant to World Bank loan Program implementation was affected by these administrative changes

Funding of the FAO TA from USAID/Jakarta has to pass through the WB system before reaching its intended destination This procedure is cumbersome Periodic disbursements that originate in USAID/Jakarta are sent to the U S Government finance center in Alabama From there the money is sent to the World Bank in Washington The World Bank sends the funds to FAO/Rome and FAO/Rome transfers the funds to the FAO IPM project in Jakarta This process has resulted in needless delays, and consequently bureaucratic obstacles within the donor community have disrupted project activities

Almost all FAO TA activities have timetables that are dictated by agricultural crop seasons Project work plans are developed and reviewed well in advance of their implementation The ground-level consequences of funding delays caused by bureaucratic malaise can be severe In the case of this project, the Indonesia FAO project was able to borrow funds from the ICP or from FAO/Rome to sustain operations while waiting for the disbursement to arrive from the World Bank, so

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2 Secondary crops grown in rice-based cropping systems

negative impacts were minimized

This experience will have more far-reaching implications as USAID explores new approaches to providing assistance in the future It is expected that funding arrangements in cooperation with multilateral donors like the World Bank will increase as USAID faces continued cuts in its capacity to manage projects, and as the donor community seeks innovative means to leverage resources

Project Implementation

The October 1997 WB supervision mission report cites evidence that the IPMTP has made progress towards achieving its objectives Human capacity development was projected to fall short of the goals established at the beginning of the project, but substantial numbers of farmers had received, or were projected to receive training by the end of the project in 1998 Nearly 600,000 farmers were expected to be trained through the IPMTP Over 500 Pest Observers, 1,300 Agricultural extension workers, and over 21,000 Farmers were projected to be trained as IPM trainers Though these numbers reflect substantial progress towards the goal of establishing IPM as national the pest management strategy, impediments in the implementation of the project kept them lower than they could have been

Friction within the Government administrative structure caused the budgeting function that maintained control of the project at the local level, in the hands of the trainers, to shift upwards to higher levels of the system In some cases, this problem was overcome by individuals who recognized the value of the IPM model and refused to allow bureaucratic obstacles to stand in the way The World Bank project management chose not to enforce stipulations of the loan agreement that would have prevented these sorts of problems Other similar institutional frictions have come into play since the project was moved from Bappenas to the MOA Though the project can demonstrate substantial accomplishments, one could argue that the original goals were not unrealistic and that with more efficient GOI and WB management they could have been realized

At the farm level, the IPMTP has added a new feature that promises to become a major factor in its sustainability Farmer trainers are rapidly becoming the dominant force for expansion of IPM The FAO TA has placed increasing emphasis on facilitating training led by selected FFS alumni The numbers cited above are an indication of the importance of farmer trainers to the future of IPM The Government's capacity to provide trainers is limited by resources and other commitments for government employees' time by their parent agencies But, it has been demonstrated that farmers who are given technical support by the Government system and training by the IPMTP can assume the responsibility for leading FFSs When farmer level training is factored into the accounting of project outcomes, the targets for trained farmers listed above will be far exceeded

Farmers as trainers evolved from experience under the establishment phase where farmers spontaneously took on the responsibility for training others Initial experiments with this approach proved to be successful and the role of farmer trainers was formalized Farmer trainers are selected from alumni of FFSs They are given specialized training in how to organized and manage a FFS, and how to organize and

act as leaders for the interests of IPM farmers as a group With the rapid growth in numbers of farmer trainers, the capacity of the IPMTP to expand is greatly enhanced beyond what would be possible if MOA personnel were the only trainers

An important outcome of the World Bank phase of the IPMTP is that FAO has led an emphasis on community-based IPM The radically refreshing goal of this effort is institutionalization of IPM at the farmer level, as opposed to the usual bureaucratic assistance model This means that selected district, sub-district, or village[3] level administrative units are targeted for IPM expansion The ultimate goal of community-based IPM is that communities – village, sub-district, or district – have an institutional structure in place for IPM training and technical support of IPM practices for all farmers By focusing on a community-based approach some synergies can be obtained to improve crop production And, management of the program is largely removed from the central Government This represents a departure from the usual mode of operation that deserves acclaim The goals of the community-based program are ambitious and aimed to benefit a heretofore weak constituency This program reaches to the core values of the farm community and proposes to establish a new form of community organization that will put the needs of the largest segment – farmers – at the highest level of priority

The process of community IPM has expanded rapidly By November 1997 the 12 provinces in which the IPMTP was concentrated boasted 215 IPM sub-districts and over 16,000 farmer trainers To achieve these results, the FAO TA group has led a program to prepare farmer trainers, not only in the technical aspects of IPM, but also in techniques for area planning and organization Financial support is required for IPM FFSs Land must be rented for field activities of the FFS Snacks and other operating expenses must be covered These expenses are small in comparison to the benefits that they generate, but nonetheless financial support is essential

Case studies of successful community IPM programs consistently reflect the key role played by farmer trainers as community organizers Careful planning leads to successful programs and the farmer trainers lead the planning process As part of their training under the IPMTP, farmer trainers are instructed in methods of group organization, planning, and presentation To develop a community IPM program, the farmer trainers must agree on annual work plans, and they present these to local government authorities to request support

The area planning process developed under the IPMTP for farmer trainers is straightforward and simple Resources available to the community are identified, objectives for the support IPM are listed, and support needed to obtain those objectives is determined Farmer trainers conduct a mapping activity to identify resources existing in their area For example, a map will be drawn for a given sub-district identifying the usual geographic features such as villages, waterways, roads, and so on Of particular interest to the IPM program, features such as location of farmer trainers, IPM field schools, cropland, and other distinguishing characteristics of the area that may be relevant to agriculture are identified This map forms the basis for identifying

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The Indonesian system of governance divides the country into Provinces, Districts, Sub-districts, and Villages

resources available to the community Community needs for the furtherance of IPM may include farmer training for those who have not yet participated in a FFS, research projects to answer questions of importance to the farmers in the community, or other activities noted by the farmer trainers Farmer trainers meet to complete this planning process in advance of the crop season in which the activities will be carried out They prepare visual aids for presentation in a large forum, and arrange for a meeting with key government officials

Farmer trainers organize the meeting and set the agenda At a typical sub-district meeting, the sub-district head, village heads, the local Ministry of Agriculture officer, Agricultural extension workers, and the Pest Observer are invited to attend Farmer trainers present their mapping exercise and lay out their plans for the coming season Questions of support, financial and in-kind, are discussed Often local government and other entities make commitments to the plan either as cash financial support or in-kind support

The strength of this process is that the strongest advocates of IPM – the farmer trainers – lead it They have been trained in the planning process and know how to advance their program through local government channels It is clearly a bottom-up exercise, and as such it is an approach that is unusual in Indonesia The over 200 IPM sub-districts already embracing the program are strong evidence of the soundness of the approach This number, which has developed over only a few years, is evidence of the likely future development path for IPM in Indonesia Farmer trainers have been shown to be competent deliverers of the IPM technology to their neighbors They have also demonstrated the ability to organize and deal effectively with the various arms of Government involved in their communities and their agricultural enterprises With the technical support of the Agricultural extension workers and Pest Observers provided through the central IPMTP, the rapidly growing cadre of farmer-trainers will ensure the continued growth and sustainability of IPM beyond the term of the USAID and World Bank project

USAID's contribution to this program has been very important The FAO TA component of the project developed the concept of community IPM and provided guidance to its implementation USAID's commitment to Indonesia's IPM training effort has generated worldwide recognition Without this commitment, there is little doubt that IPM training in Indonesia would look very different from what it is today FAO, provided with the financial resources from USAID/Jakarta, has provided leadership in the development of the IPM training curriculum, and it has maintained an institutional presence in Indonesia through which it has exerted considerable influence over implementation of the program

World Education/Indonesia

From October 1990, USAID/Jakarta has supported work by World Education/Indonesia on projects operated in collaboration with local NGOs The focus of WEI activities has been IPM training, but other ancillary programs are also involved The WEI program has been funded at a level of $1 75 million and has been implemented in three phases All phases have the unifying theme of environmental management through enlightened use of pesticides and the collaboration of WEI with

Indonesian NGOs

While the WEI approach to IPM follows the same nonlinear experiential training model described above, their activities at the field level are independent of the national IPMTP WEI programs are focused in specific communities and frequently deal with crops that are not part of the mainstream IPMTP WEI work falls under the same umbrella as the FAO effort in farmer led IPM system development and their work is complementary to and supportive of the IPMTP

WEI's approach to farmer training is based on the same principles as the FAO design Lessons learned through the IPMTP have benefitted WEI's program development and vice versa In both cases, the key elements of effective IPM training are that training is conducted in the field through a complete crop season, and that trainers lead a process of discovery by the farmer trainees, as opposed to giving directives for packages of farm practices Also, both programs recognize the value of farmer-trainers as the leaders of FFSs The role of the WEI/NGO network is to provide the backstopping necessary to handle administrative and technical problems beyond the scope or capability of the local participants, and leadership in the development of new approaches to achieving common objectives

USAID support to WEI contributes to development along two thematic paths Environmental management through IPM training is one theme WEI possesses technological skill, management capability, and training experience to enhance the capacity of local organizations to carry out their IPM training functions Because of the relatively small scope of WEI's projects, they are in a position to fine-tune the training process and experiment with new approaches As a result, WEI can develop improvements to the FFS model that can be incorporated later by the IPMTP

The second theme is to support local NGOs By providing technical assistance and sub-grants to local organizations, WEI functions as a facilitator for organizations independent of government to organize community groups to achieve environmental and community objectives Often the community objectives are specific to a limited area, or group of participants, clearly in the purview of an NGO rather than a government agency To the extent that the network of NGOs dealing with IPM is strengthened, the more general national goal of developing sustainable agricultural systems will be realized more easily

WEI's project in Indonesia builds on previous experience in the Southeast Asia region in association with the FAO ICP WEI was involved at the early stages in the conceptualization of the participatory IPM training model In Indonesia their program has built on this experience and their USAID-funded project, "Improved Environmental Management and Advocacy (IEMA) with Indonesian Nongovernmental Organizations,' has contributed to the national IPM training effort Through three phases since 1990 the project has extended the training model and expanded the efforts of several local NGOs involved with IPM training

The WEI program is flexible in its approach, building on community efforts in selected areas and the particular issues concerning those communities Examples of these types of efforts are given by the project of an NGO in North Sumatra working with cabbage and potato growers Farmers are trained in IPM and have significantly reduced the amounts of pesticides used on their crops without sacrificing yield Net incomes of IPM farmers are therefore higher than those who do not follow IPM The

production area where this project is located is easily accessible to export routes to markets in Malaysia and Singapore Those markets have strict pesticide residue requirements and Indonesian cabbage has been refused because it failed to meet those standards The NGO project is exploring opportunities for the IPM farmer group to establish regular export channels for their low residue products Successful ventures of this sort would further increase incomes for the exporting group, enhance the value of IPM in the eyes of other farmers, and benefit the local economy

Technical support is provided through WEI and the local NGO, either directly or by their ability to access necessary expertise The goal of the program is to be farmer run, and the training provided by the WEI project focuses on developing organizational skills as well as production expertise Export markets for Indonesian products in the region are large and growing, especially for high-value fresh vegetables Local markets are also growing rapidly as the general income level in the country increases Providing customers with plentiful and safe food will grow in importance in the future

A second example of a WEI effort in collaboration with a local NGO is in Central Java A health study conducted in the major shallot growing area of Indonesia found that pesticide use is dangerous for several reasons To combat the main shallot pest, the beet armyworm, growers typically apply insecticides as often as two to three times per week Frequently, more than one insecticide is applied in a single spray and usually a fungicide is also added The study found that applicators seldom used recommended protection to shield themselves from the toxic sprays, and in almost all the cases observed, their equipment leaked Pesticide poisoning was inevitable, and most applicators consider the symptoms to be one of the costs of doing business Downstream effects through contamination of water systems that directly link farm irrigation to household uses are also serious

To address this situation, WEI and a consumers' union NGO in Semarang, Central Java undertook a community education campaign By providing the information to the news media and through local meetings, the campaign resulted in a response that will improve the situation Local advertising of the dangers of indiscriminate pesticide use improves the awareness of the local population and raises the concern of consumers and users of pesticides Policy-makers are also informed of the problems This effort was strong enough to result in a policy change that will require improved labeling of agricultural pesticides Public awareness is difficult to measure, but the consumers' union program is correctly targeted to an important issue In concert with a program of IPM training in the area to improve the quality and safety of food produced, the NGO project has vast potential for positive benefits

These examples of WEI activities are important and they demonstrate the flexibility and effectiveness of working with local NGO projects However, on a wider scale, the WEI program is tied by the common thread of IPM training Local NGOs with farming and environmental agendas can provide the technical and organizational expertise to applying experiential IPM training Assistance from WEI in training design and curriculum enables the network of NGOs to extend the IPM model to key farmer groups that would not be possible without WEI's backstopping capacity

During the course of WEI s experience with IPM training in Indonesia, the

program has progressed from identifying and establishing relationships with partner NGOs to implementing FFSs and developing specialized curricula responding to farmer needs Empowering farmers to take on the leadership role in organizing their peers and leading training efforts is the most likely means to extend IPM training in the future With NGOs as the source of backstopping support to farmer leaders, WEI is in the process of implementing a program that will establish a coordinating unit to ensure communication among NGOs on new developments in IPM training Understanding that group activities, collaboration, and peer reviews are critical elements of sustained high quality IPM training and organization, this coordinating unit will strengthen the NGO network's ability to further their individual and collective agendas

WEI plays a facilitator role in the process of human resource development Given the vision that expansion of IPM training will be driven by large numbers of farmer-trainers, WEI and the NGO network are called upon to design programs to improve farmer-trainers' technical skills To address this issue WEI is instituting a program to upgrade the skills of farmer-trainers through training of trainers (TOT) programs in three provinces WEI produces case studies analyzing farmer-trainers and their roles as community leaders On the technical side, WEI produces field guides for IPM trainers on crop production issues and on community organizing More recently, WEI is focusing on improving farmers' skills as experimenters through the TOT program

To ensure that farmers who have completed a FFS maintain their commitment to IPM, WEI seeks ways to institutionalize post field school activities for FFS alumni Regular meetings of alumni groups are held to discuss crop management issues and obtain technical advice from specialized experts These meetings will serve to reinforce the lessons learned in the FFS and maintain the viability of the IPM system These follow-up programs are particularly important for vegetable farmers for whom pest problems are especially complex

Institutionalization of IPM at the local level is a goal of the national program and others concerned with sustainable development of agricultural systems WEI is addressing institutionalization issues by facilitating sharing of experiences among the NGO community The WEI program for its final year of USAID funding includes a workshop to bring together NGO representatives to discuss their projects Also, a series of exchange visits is planned for NGO personnel to visit sites where IPM has evolved from FFSs into an integral component of local culture

WEI has played a key role in the development of IPM in Indonesia Up to 5,000 farmers per year have been trained through WEI and collaborator programs IPM trainers have also received advanced technical training under the program By focusing on key farm communities with established NGO structures in place, WEI has made significant contributions to those communities by strengthening the NGOs and improving the farmer IPM training program WEI has been able to facilitate some key innovations in training and some specific ancillary projects These activities ultimately promise to benefit not only the farmers directly affected, but also the broader community

Clemson University

Integrated Pest Management Research, Development, and Training Activities for *Palawija* Crops in Indonesia

The research base for rice IPM was well established before the IPM training programs were begun Although technical advances have continued to be made, the most important development for rice was the training method By contrast, the research base for vegetables and *palawija*[4] was not well developed, but many farmers also desired IPM training in these secondary crops USAID/Jakarta contracted Clemson University to provide technical assistance to address this problem The overall objective of the Clemson University *Palawija* Project was to provide research and assistance that support and enhance the IPMTP for the development of adapted IPM systems for major insect pests of *palawija* and vegetable crops The two-year project was initiated in October 1992 It was subsequently extended through October 1997 at a total funding level of $2 3 million

During the five years of this project, Clemson maintained a senior research scientist with expertise in biocontrol of insect pests in Bogor The senior scientist led a research effort to develop IPM systems for soybean and selected key vegetable crops He was supported by consultancies of international experts to extend these efforts The project headquarters was housed in the Ministry of Agriculture's Bogor Research Institute for Food Crops (later changed to Institute for Biotechnology Research) USAID/Jakarta provided funding to completely equip the laboratory to function as the center for IPM research

The primary responsibility of the Clemson Palawija Project was to develop IPM systems and provide input to the IPMTP The project operated under the supervision of the Research Committee of the IPMTP All research efforts were conducted as collaborative efforts with various components of the IPMTP Training materials such as field exercises or field guides for IPM techniques were provided for use in FFSs

The focus was on field problems related directly to discovering economical and ecologically sound alternatives to the common chemical-based pest management systems applied by almost all Indonesian farmers The bulk of research program was conducted on farm sites in major growing areas for the various crops, and day-to-day activities were managed by collaborating partners associated with the IPMTP

In general, the research program progressed from survey activities to identify pest management problems and potential biological control agents, to testing alternative strategies, to field demonstrations of viable IPM options and production of relevant materials for use in training Surveying local conditions was an important first step for the research program While the crops of concern to this project encounter common pest problems around the world, local conditions have unique impacts Surveys are necessary to identify problem pests and potential biocontrol

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[4] *Palawija* refers to secondary crops planted in rice-based cropping systems Soybean and corn are common *palawija* crops

agents During the first two years of the project the senior scientist was an entomologist specializing in insect pathology Over 25 new pathogens related to insect pests in Indonesia were identified during those first two years One is found on a pest species that causes significant harm in other parts of the world, but not in Indonesia, perhaps because of this natural control An insect pathogen was found on the beet armyworm in other parts of Indonesia and brought to the shallot area of Central and West Java where it is being incorporated into a very promising biocontrol program there

During the last three years of the project, the senior scientist based in Bogor was an expert in predators and parasitoids of insect pests He was supported full time by a post doctorate assistant with a specialization in insect pathology The research program under the project built upon the experience of the first two years and expanded to include more work with predators and parasitoids The work also expanded to other parts of the country Though the senior scientist was based in Bogor, West Java, field research was conducted in North Sumatra, West Sumatra, Lampung, South Sulawesi, North Sulawesi, Nusa Tenggara Timor, East Java, and West Java

The ability to conduct research in many distant locations was due to the close collaboration of the many individuals and agencies allied to the IPMTP For example, the local Plant Protection agencies in West Sumatra, South Sulawesi, and East Java collaborated on activities in their areas The FAO TA component of the IPMTP maintained a Ph D biocontrol expert in East Java who collaborated on research there University scientists from institutions in Lampung, North Sulawesi, Nusa Tenggara Timor, West Java, and East Java conducted cooperative programs with the Clemson group Clemson scientists provided assistance to WEI and its NGO collaborators, especially on their program in North Sumatra These are examples of the synergy that emerges from the network of organizations concerned with developing viable IPM systems

Over time the research program dealt with soybean and the most important vegetable crops including cabbage, chili peppers, shallots, potato, longbean, leaf onions, and others Each crop has unique pest problems that vary during the season of the year – wet or dry – and geographic location The Clemson project served to unify IPM research and as a conduit to transfer knowledge gained in one location to others with similar problems The shallots program is an excellent example of the benefits of this position within the national system

Shallots and cabbage are heavily sprayed with chemical insecticides to control the beet armyworm on shallots and other insect pests on cabbage It is not uncommon that these crops are sprayed up to 30 times per week when pest infestations are severe Usually the chemical pesticides are ineffective because of resistance and the natural protection from the chemical that the pests gain by burrowing inside the plant By identifying natural control agents, found on the same pests in other parts of the country, systems can be developed for the major growing areas that have the potential to supplant the chemical-based system in common use In the case of shallots, a microbial control agent that can be propagated, maintained, and applied by farmers is the core of a biocontrol IPM program that will revolutionize shallot production in Indonesia Field tests and demonstrations have been conducted by the Clemson group

and are being expanded through the Action Research Facility established by the FAO project in Central Java

The program for cabbage is similar to the shallot system in that drastic reductions in chemical insecticides are possible by shifting reliance to biocontrol options In some parts of Indonesia parasitoids of cabbage insect pests maintain adequate control and little or no chemical pesticide use is needed Intense chemical insecticide use prevails where the parasitoid is not found Field tests and demonstrations in North Sumatra, with the WEI program there, show that the parasitoid combined with occasional localized treatments of the commercial microbial agent, *Bacillus thuringiensis*, provide effective control without sacrificing yield The resulting product is devoid of chemical residues that may reduce it marketability, especially for export

These IPM systems were identified and first tested in the areas mentioned, but they have subsequently been successfully tested in other parts of Indonesia The systems are easily implemented, but farmer training is essential The technology is simple, but an understanding of the functioning of the system is important For example, propagation of the microbial for use on shallots is easily done with materials that are readily available Farmers can be trained to produce their own supplies However, once propagated, the agent must be kept cool to maintain its viability

In the case of the cabbage system, training is critical because chemical sprays will kill the parasitoids Therefore, farmers who implement these systems must ensure that a proper habitat is maintained to protect the biocontrol agents Since the actions of one farmer may affect the IPM system for others, the community of neighboring farmers must cooperate to obtain best results

These are examples of the approaches taken by the Clemson Palawija Project Research has also been conducted on other crops with results that will be fed into the training program The research output gained from the project has been documented for the IPMTP in the form of written reports and training exercises The larger research community in Indonesia has benefitted from the Clemson project through the participation in various workshops, seminars, and informal meetings where IPM topics are the theme

Collaborative Development of Integrated Pest Management Methods for Secondary Food Crops in Indonesia

The University Development Linkages Project based in USAID/Washington provided funding for a collaborative project between Clemson University and the *Institut Pertanian Bogor* (IPB) [Bogor Agricultural University] in October 1993 The project is scheduled for five years with total projected funding of $499,000 This project builds upon the Palawija Project by establishing an official mechanism for collaboration between the two institutions and the funding for travel and to conduct research on topics of mutual interest Objectives of the project, in addition to conducting research, are to enhance the capability of IPB to function as a center of IPM expertise in Indonesia and to expand the international focus of Clemson University

The most important contribution of the linkage to IPM in Indonesia has come

through the field research activities that have been funded by the project Through the linkage, funds have been made available to support several research projects, many of which have led to graduate theses and dissertations Many of these projects have been more long-term in nature than the field demonstrations and tests done under the Palawija Project, but they too have been primarily motivated by the needs of the IPMTP to serve the farming community

Though the project is established between Clemson and IPB, other Indonesian universities have derived benefit Since IPB is a longstanding center of higher education for the agricultural sector, its alumni can be found in most other agricultural institutions in the country The alumni network maintains contact and IPB has provided leadership and funding to support research work in locations outside the normal scope of IPB activity For example, IPB faculty have worked to enhance the capacity of Cendana University in Nusa Tenggara Timor Linkage resources were used to support some of the field research work conducted there

Linkage funds have also been used to support seminars and workshops to extend knowledge of IPM to interested persons outside the research community As part of the national effort to support IPM, workshops have been conducted on several topics Using linkage funding, international and local experts have been brought together to share their expertise with advanced students and junior faculty from other universities, and field workers from the IPMTP, the Ministry of Agriculture, and NGOs working in IPM Workshop topics have covered a variety of topics including general biocontrol, plant pathology, nematology, and sharing results of field tests from different parts of the country IPB and Clemson have participated in all these activities and other cooperators have joined the effort as well

The IPMTP supports similar programs, but the additional resources provided through the Linkage Project enhances the spreading of IPM knowledge beyond what would be achieved otherwise IPM research is a rapidly expanding field, especially for the secondary crops, and sharing of knowledge among researchers speeds the process Sharing with field personnel is essential for the ultimate goal of farmer training

Perhaps secondary to the short-term efforts at IPM training, but important for the long-term goal of creating a solid IPM research community, the Linkage project has enabled selected IPB scientists to visit Clemson University and interact with researchers there Many of the pest problems encountered by soybean and vegetable producers in South Carolina are similar to problems encountered by their counterparts in Indonesia Three junior faculty from IPB have gone to Clemson for Ph D training One is funded by a Japanese higher education project to support study abroad by Indonesian scientists The other two are funded by a Ministry of Education project to enhance the capabilities of IPB faculty

The Linkage project has added an important element to the enhancement of IPM in Indonesia In a manner similar to the way that WEI assists the NGO community to expand their capabilities, the Linkage functions to provide IPB with technical expertise from the Clemson group and funding to respond to critical research needs This funding mechanism is in contrast to the traditional system of proposal submission, review, and eventual provision of funds In the spirit of the national IPMTP, the Linkage allows IPB to allocate resources to respond to critical needs

Examples of this process are the shallot program in Central and West Java, and

the identification of a new pest and related field studies IPB has taken the leadership in conducting extensive field tests and demonstrations in the shallot area IPB field workers have established a research program in the area and a field laboratory that has been active for over two years Linkage funds support this work

Recently a new pest, a leaf miner, was found to be causing severe damage on potato and other vegetable crops This pest is known in other parts of the world, but it was not previously important in Indonesia Over the last few years, leaf miner populations have rapidly expanded and it has devastated crops in some areas In some places farmers have ceased planting potato because they cannot control the pest Chemical insecticides are ineffective because the pest does its damage from inside the leaf IPB scientists are conducting research to develop IPM strategies to combat this pest using Linkage resources The turnaround time between identification of the problem, design of the research program, and implementation was very short

An unanticipated benefit of the Linkage project occurred as a result of the recent economic problems in Indonesia and other parts of Asia Since IPB is a government institution its budget is affected by changing national priorities Budget tightening that has come about due to national economic stress has reduced IPB's operating resources Funds available through the Linkage have allowed the IPB program on IPM to proceed without serious delay

South Carolina State University

Under USAID/Washington's program for Research Grants to Historically Black Colleges and Universities, South Carolina State University was awarded a $100,000 grant to conduct a study of the economic impact of IPM training for selected secondary crops in Indonesia Clemson University participated on the project under a sub-contract with SCSU The project was designed to evaluate the long-term effects of IPM training on cabbage and potato in North Sumatra, West Java, Central Java, and East Java

Graduate students from IPB collected the data from trained and untrained farmers in each province with graduate students from Clemson and SCSU accompanying them to some of the sites Farmers were surveyed with a questionnaire based on issues related to IPM practices Though the data have not yet been fully analyzed, some results are available A Master of Science project was completed at Clemson where the student established an IPM ranking for each respondent based on a point system for IPM versus non-IPM practices Results in general confirmed that training, which in all cases was conducted in 1993, had positive benefits IPM trained farmers continue to employ practices learned through the training program

II LESSONS LEARNED

Support of a good idea works

While much can be said of the details of the initiation and implementation of IPM training in Indonesia, scientific merit and farmer need for the program form the foundation of the IPMTP Post Green Revolution agricultural systems in the tropics were, and for the most part still are, on an unsustainable course Excessive use of chemical pesticides distorts biological systems that react following normal evolutionary patterns to overcome the chemical perturbations Increased reliance on chemical pesticides ensues because the farmer, whose livelihood depends on protecting his crop, knows no alternative The "pesticide treadmill' is the result, and this is a system that cannot be sustained long into the future

The problems posed by the "pesticide treadmill" were recognized by key figures in the Government, USAID, and other international institutions USAID resources were made available at a critical moment to provide the catalyst necessary to get the training program started

IPM in rice was a proven success Experience showed that the IPM alternative to chemical-based pest control would reduce production costs without sacrificing yield Thus, the technology was available The critical need was its transfer to the farmer through training The science was sound and the need was well established, widespread, and recognized by authorities in a position to act USAID project officers recognized the potential of IPM training at a time when the Jakarta Mission had funds available to support GOI initiatives for rural development Success of the program was dependent on the implementation of the training effort, not on the technical merit of the new approach to production management

Top level government commitment was essential

Implementation of IPM training in Indonesia required important political decisions affecting the institutional structure of the program infrastructure Decisions were made at the ministerial level to house the IPMTP Establishment Phase in Bappenas instead of the Ministry of Agriculture where is would more logically fit This decision was taken because of vested interests of MoA officials that would have prejudiced IPM training, and probably rendered the program ineffective By placing the IPMTP in Bappenas, it was possible to begin the program without major hindrance from Jakarta-based bureaucrats The program then was able to establish its credibility in the field where the strong support of farmers and local government soon developed

Though the ultimate benefit of the IPMTP is at the local level, and though the future of the IPMTP will most likely depend on district and sub-district resources, farmer acceptance was engendered early in the life of the program, when local authorities were unaware of the program's potential impact on their constituencies The institutional protection that was offered by placing the program in Bappenas allowed the training staff to focus their energies on developing training methods and managing the many field activities that were occurring at a rapid pace

An implementing structure, provided by the FAO project, with interests solely focused on providing IPM training was critical

The FAO project brought to the IPMTP a team of dedicated highly competent professionals who have provided the leadership needed to get the program started and to keep it running as efficiently as possible The core make-up of the FAO team has been in place since the beginning of the IPMTP They include a few key international experts and a large group of Indonesian nationals who have provided the driving force to keep the program on track and ensure that program resources are channeled to the farm level where they were intended

The value of this component of the IPMTP cannot be overstated The massive effort that farmer training entails requires an extensive network of cooperating agencies and key individuals The central government provides resources, obtaining USAID grants and World Bank loans in addition to national sources, and is ultimately responsible for the utilization of those resources However, local and regional governments also play important roles in the implementation of the program, and management of resources that flow from the center The network has become more complicated as the program has grown, with training activities taking place in several provinces and many separate locations within each province Management and coordination of the resource flows is not the responsibility of FAO, however, the training experience that is the ultimate goal has been largely dependent on FAO leadership The high quality of IPM training in Indonesia is due to the contribution of the FAO project

A development effort such as IPM training in Indonesia could not be successfully pre-programmed Implementation of training began immediately after the contract for the FAO project was signed The general methodology was known, and some training materials had been prepared, but much of the substance of training was determined while it was in process in the early stages Conditions vary from one location to another which require some accommodation within the curriculum As with any training effort, some things work and others do not It is not always possible to tell which is which before training occurs In addition, institutional vagaries cause the support network to differ from place to place These factors imply that flexibility and the ability to adapt are critical elements of a successful program Continuous evaluation and revaluation contributed importantly to the development of a world recognized example of how IPM training should be done

The FAO project team has provided the continuity and the focus required to shepherd the growth of the training effort Local support and enthusiasm that translates back to the center is a clear indicator of the success of FAO s leadership The training is high quality Farmers recognize the value of the training Local officials listen to the positive feedback from their constituents The program expands because it works and because its value is widely spread Training is designed to respond directly to farmer needs and to empower farmers to marshal the resources they need to conduct their affairs Without the FAO project, IPM training in Indonesia would not have achieved the results that are internationally recognized today

USAID must be aware of the advantages and disadvantages of channeling funds through other donors

USAID was able to accomplish some important goals by channeling financial support to the IPMTP through the World Bank loan project At a time when USAID project management staff in Indonesia was being reduced, savings of staff time were achieved by shifting part of the responsibility to the WB Using this approach, USAID was able to provide funding for the FAO component of the IPM effort in Indonesia, an element that was a proven success and that provided key input to the program

When the WB loan was being negotiated, some individuals within the GOI saw the opportunity to remove the FAO project in an effort to further their personal interests Others felt that the FAO project was essential to the training effort USAID recognized the critical role of the FAO project and undertook to provide the resources necessary to maintain the FAO presence under the new WB loan project After considering alternative means to provide the requisite financing, it was finally determined that USAID would provide grant funds to the GOI with the express purpose of funding the FAO IPM training project, however, the grant would be administered by the WB and disbursements would be made through the Bank This process freed USAID from part of its project management responsibility thereby reducing the workload of the Mission

In practice, the system has not worked as well as it was designed to World Bank project management staff have not displayed a fundamental understanding of their project For that reason, the Bank has failed to require adherence to provisions of the loan dealing with GOI management of the program For example, project finance flows direct to local managers were disrupted by needless redirections through multiple agencies further removed up the bureaucratic hierarchy from the actual training activity These and other deviations from the project design have reduced the potential impact of the IPMTP FAO has argued strongly for a more enlightened Bank involvement in the project

Disbursements of USAID grant funds to FAO have not flowed smoothly through the Bank Delays have been the rule rather than the exception The last disbursement was mysteriously lost in the mail between the Birmingham U S government finance center and the World Bank in Washington, DC, before it was finally found after some weeks delay Needless bureaucratic friction such as this translates to real disruptions in program activity

Cooperation with multilateral donors through arrangements such as this offers USAID a means to provide critical support to further its strategic objectives, and to leverage that support by joining the larger effort of the multilateral This arrangement also places USAID in a key role to exercise influence on the implementation of the total assistance package USAID needs to be aware of its opportunities and responsibilities with respect to these sorts of cooperative endeavors Often USAID may find that because of its well-trained technical staff and understanding of development goals, it may be in a position to exert a disproportionately large influence over project implementation

Local people can manage programs and make them work

One of the most important lessons learned from the IPMTP experience in Indonesia is that farmers are capable of organizing and leading efforts to achieve their common goals IPM training has been extremely well received by Indonesian farmers The IPM system approach to "growing a healthy crop" fits farmers' intuition of how crop production should be done IPM training, therefore, fills a niche that was previously empty in that understanding of the ecological implications of farm practices is brought into focus Once trained, farmers understand the fundamentals of crop production much better, and they are understandably enthusiastic about wanting to share this new found intelligence

Farmers themselves have become trainers The number of farmers being trained by other farmers is rising dramatically, and will continue to rise in the future Farmer-trainers have developed the skills to manage budgets, organize and lead meetings, and function effectively in the political milieu at the local level Thus, farmers have demonstrated that the empowerment provided by IPM training involves more than the relationship between the farmer and his fields

The future focus of the FAO effort on IPM training will be on community IPM This implies a system of IPM training that is led by farmers and supported by local government Clearly there remains a role for support from the center, but that role is to provide technical, and perhaps some financial, support as opposed to program direction in the traditional top-down mode

The human infrastructure needed to make community IPM work will determine the future of the IPMTP Farmer-trainers will need technical support to understand and adjust to changing ecological problems that arise in dynamic agricultural systems That support role will be provided by Field Leaders and Pest Observers who in turn are supported by the research structure of the Ministry of Agriculture It will be very important that MOA Field Leaders and Pest Observers continue to include IPM program support as an integral component of their job descriptions

An equally important role of farmer-trainers is to plan and organize community programs Farmer-trainers have demonstrated the capability to plan and organize research and training activities, and present these plans to government entities Given the limitations on local government discretion over use of funds, requests for funding of IPM training efforts must be compelling if they are to be successful Farmer-trainers have shown that they can develop detailed assessments of resources and needs of their areas and present these findings to local government officials with specific requests for financial and in-kind assistance The traditional linear model of development would not admit the leadership role assumed by farmers in the IPM model

NGO's serve an important role as counterpoint to government

NGOs have played an important role in the development of IPM training The NGO role is complementary to the IPMTP Both have the same objective of providing IPM training to farmers, and both are dedicated to the participatory training experience However, in practice, because NGOs are typically distrustful of government programs, they seek to implement programs with little reliance on government support In the case of IPM training in Indonesia the NGO program has provided an avenue to demonstrate the potential for successful community organization to achieve the objectives of local farmers, and the ability of farmer-trainers to conduct FFSs Though the IPMTP has embraced these approaches, they run counter to typical linear government programs NGOs are in a position to test the methods and show that they can be effective

NGO programs can focus on specific objectives, and therefore lead innovation

Since NGO activities are focused on a limited range of issues, they can focus on more specific objectives than is possible with broad national programs For example, NGO activities related to IPM can be designed to concentrate on high value vegetable crops in a single production area, such as North Sumatra Activities can be designed to concentrate on international marketing of the produce of a selected group of producers These sorts of activities are difficult to justify as national programs run through the central government, but they provide a valuable service to the target groups for which they are aimed

Because of the localized nature of NGO programs, they can take risks that national programs cannot NGO training efforts are well suited to experimentation with new methodologies Because the number of trainers and trainees is limited, NGO programs can readily adapt new approaches that work, and discard approaches that do not work In this way the NGO community serves a valuable development function to discover and test training methods that can then be incorporated in the national program

In the short-run, markets for IPM products can be separated from the broad commodity markets IPM produced vegetables, for instance, are safely within acceptable standards for chemical residues and therefore can be marketed as healthier alternatives to the produce commonly found in the marketplace The NGO program that seeks to exploit this marketing advantage for the benefit of the IPM growers, if successful, will lead to similar efforts by others The long-run expectation is that IPM produce will become the standard

Activities such as this are clearly in the purview of the NGO community They play a leadership role in the advance of socially desirable alternatives to traditional ways of doing business Similar examples can be cited where NGOs act as the testing ground for subsequent adoption on a national scale

Research is important to continued improvement of IPM training

Agricultural production systems are dynamic Crop ecology changes over time in ways that are not predictable The basis of IPM training is to equip farmers with the ability to recognize and adapt to the dynamic nature of their fields Research at all levels is necessary to respond to changes that occur

In the FFS farmers are exposed to simple experimentation techniques that they can apply in their own fields This type of research enables the farmer to adapt to the unique characteristics of his situation At a more generalized level, research that is widely applicable is necessary to cope with changing pest management and crop production patterns

The IPMTP has benefitted from a variety of research efforts International efforts, much of it driven by the International Rice Research Institute, including participation of Indonesian scientists formed the research base of IPM systems Research specifically targeted to the Indonesian context is conducted by the Ministry of Agriculture and university research systems The FAO project and Clemson University have provided international experts to assist the IPMTP These efforts have led to major contributions, but much remains to be done

IPM systems represent a move toward sustainable agriculture To ensure sustainability, research must be an integral component of the process Opportunities exist to obtain significantly large economic and environmental impacts through development of new IPM technologies

The link between field research and the IPMTP must be clear and communication channels open and efficient

A systematic research effort that links scientific discovery to the IPM training effort is an important component of the IPMTP Feedback channels are critical to this effort Researchers need to be knowledgeable of the practical crop management problems that farmers face Farmers need to have rapid access to research findings

The research component of the IPMTP is slow to respond to evolving needs The system that requires proposals to be submitted at designated times for subsequent review and later funding is common among research institutions, but inefficient for many of the key questions involved in IPM training situations The Clemson University projects offered an alternative, with funding and expertise in place full time with the responsibility to support IPM training Through the Linkage Project, IPB scientists too are able to quickly design and implement field studies to react to new problems, such as the *Liriomyza huidobrensis* pest Through this capability Clemson and the many cooperating scientists have contributed a large body of research information and training exercises directly to the IPMTP The IPMTP should develop a mechanism for flexible, quick response research to contend with new problems or expand study of promising new opportunities

The *L huidobrensis* issue is an example of a new problem that did not exist only a short time ago It was first identified in Indonesia in 1994 Now *L huidobrensis* has become a major pest problem that is causing some farmers to stop

production because they cannot control it Farmers and extension field workers are in need of technical assistance to develop control strategies A responsive research program is needed to bring resources to bear on this problem Through the Clemson/IPB Linkage Project work is underway However, a long-term institutional commitment is needed by the IPMTP to make this type of activity possible

In a similar vein, the discovery of the microbial agent SeNPV to control *Spodoptera exigua* on shallots offers an opportunity to make a dramatic change in pest control on that crop The microbial agent is a safe effective alternative to chemical insecticides Field studies supported by the Linkage Project have demonstrated the effectiveness of the process It has been shown that farmers can readily learn to propagate and apply the microbial with little difficulty Clemson and IPB scientists led the research effort, centered in the major shallot growing area Farmer cooperators conducted the day-to-day tasks with the help of technicians from IPB who were responsible for monitoring the field demonstrations and collecting the data needed to evaluate the impacts This field oriented demonstration effort was possible because the resources were available and the expertise in place to quickly take advantage of the discovery of the microbial agent Transfer of the new IPM system to other important shallot areas was accomplished through the network of field leaders of the IPMTP

Research based in ARFs offers the opportunity to speed the process of technology transfer

Action Research Facilities (ARF) are components of the IPMTP that act as centers of farmer research An IPMTP technician, whose job is to facilitate farmer research, manages each ARF The ARF provides an institutional structure to implement research that is oriented to adapting IPM systems to local needs in key production regions The ARF structure allows farmers to test new approaches to crop management and to experiment with fine-tuning of farm practices to adapt to local characteristics This structure provides fast feedback to the IPMTP and to other farmers in the vicinity of the ARF

The ARF structure is a critical element of a long-range IPM program strategy that recognizes the dynamic nature of the biological systems involved Through this structure, farmers are actively incorporated into the research-extension process Thus, the ARF represents a significant departure from the traditional linear model, and a major step forward by the IPM alternative

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[5] Production of potatoes in West Sumatra was reduced by 40 percent in 1996/97 because of damage by *L huidobrensis* or farmers shifting production to other crops because of the risk of *L huidobrensis* attack

A full-time international IPM scientist expands the quantity and quality of IPM research

The Indonesian research community, whether in a university or the MoA system, is bound by institutional constraints that restrict the time and resources dedicated to IPM research This situation is not unique to Indonesia It is common worldwide Through the Clemson University Palawija IPM Project, it was possible to keep an international IPM scientist in Indonesia for the sole purpose of conducting IPM research to support the IPMTP That scientist became a focal point for research by many others Support from other international experts was obtained through the project to address particular IPM issues National scientists worked in collaboration and used the facilities provided by the Palawija Project to further their own efforts and to expand the knowledge base for IPM training Thus, the benefits provided by the resident expert amounted to more than the output produced by one person

In its long-range plan the IPMTP should make provision to maintain a senior scientist in a similar role to the one provided through the Clemson project Indonesia has a number of well-known highly qualified pest management experts An official position should be established under the IPMTP to place one or two of these in a position to conduct and advise on IPM research independent of ancillary university or MoA responsibilities The IPM laboratory in Bogor, equipped by USAID for the Clemson project, would be an ideal location to center this effort

Linkage Project activities strengthen Indonesia's institutional capacity to support IPM

The Clemson University/IPB Linkage Project serves an important strategic role in the institutional structure of IPM in Indonesia Many of the research activities, described under other headings above, are conducted by junior staff or students from IPB These researchers will enter more important positions as their careers develop Early exposure to research with direct application in IPM training will lead to further similar efforts in the future IPB has the expertise, and through the linkage the resources, to introduce young scientists to real world research programs

The Linkage has also enabled IPB to take advantage of Clemson University senior faculty to advise on curriculum issues related to IPM Junior faculty from IPB are currently pursuing Ph D studies at Clemson They will return within the next few years to assume leadership roles in IPM instruction at the university level

Providers of assistance must make long-term commitments to development of IPM systems

American universities can play a leadership role in developing IPM systems, but long-term commitments must be made by both the university and USAID for this to happen USAID support for this type of activity helps the university, the developing country collaborators, and the IPM training effort

Tropical agriculture offers a prime venue for IPM research Cropping systems that are not interrupted by winter freezes and forced inactivity require continuous

attention to evolving crop management issues Much of the benefit of the study of these systems is transferable across national boundaries, thus international collaborative efforts are easily justified However, significant time is required to develop a fundamental understanding of the cropping systems, to search for plausible innovative practices, and to test their viability in the context of the farm community There is a role for short-term assistance for specific problems, but the greatest benefit is achieved by dedicating long-term efforts to the more generalized issues presented across the many crops and production areas involved in the IPMTP

Personal and institutional relationships solidify over time and lead to synergies that have proven very beneficial in the Indonesia IPM program experience There is no clear end point to the need for technical support of sustainable agricultural systems Institutions that house the experts involved in developing IPM programs must bear the risk associated with allowing their personnel to dedicate the time necessary to achieve results The payoffs have been shown to be substantial

III RECOMMENDATIONS FOR USAID ACTIVITIES TO DISSEMINATE THE INDONESIA EXPERIENCE AND EXPERTISE TO OTHER COUNTRIES

Complement the FAO ICP

FAO has played an important leadership role in the development and dissemination of IPM programs internationally Efforts in Southeast and South Asia have led to training programs in several countries that emulate the program in Indonesia Many of the lessons learned from Indonesia have been instructive for programs elsewhere Several Indonesian training leaders and plant protection scientists have shared their expertise with counterparts in other countries These experiences have been productive and useful for all concerned parties

The scientific basis for IPM programs is transferable from one country to the next FAO has found that the participatory training approach is also transferable, transcending cultural differences Community based IPM projects are underway in several countries, though with varying degrees of success USAID should critically examine these efforts to determine the principal unifying themes reflecting successful approaches and constraints on the process of IPM adoption These will relate to all levels of the policy implementation spectrum

Policy

At the policy level, the Indonesia experience has demonstrated that a commitment on the part of the Government is essential for a national program, especially in a country as geographically and culturally diverse as Indonesia Policies supporting IPM may take many guises including direct support of training, but also including explicit production input subsidy policy, commodity price policy, quality

standards, and land use and tenure policy Others may also enter the picture as government intervention affects the pattern of farmer behavior

Policy support of IPM is important and it requires a long-term commitment A program with the dimensions of Indonesia s requires policy to implement farmer training and to support the infrastructure required to sustain the training effort For example, the Ministry of Agriculture must train and realign duties of field personnel to backstop IPM-trained farmers and to facilitate expansion of training Given the dynamic biological systems involved with food production, IPM research must be accorded high priority and funding made available on a long-term basis Government must be steadfast in its IPM advocacy to withstand the efforts of the pesticide industry to undermine IPM programs

IPM efforts must stand on a firm policy foundation If an IPM training effort is to be national in scope, then national policy must be formulated and sustained IPM at the local level will also require some degree of policy support IPM programs are public goods in the sense that private markets cannot be relied upon to promote IPM In contrast to chemical pest control systems, the benefits and costs of IPM are not easily packaged for marketing Therefore, the degree of public commitment to IPM will affect the scope of IPM adoption

USAID should take a strong stand in support of IPM policy formulation IPM clearly fits under the USAID objective of promoting improved environmental stewardship It also improves health conditions for rural populations, and it enhances economic growth of a major segment of the farm sector, a group that is typically found near to or below the poverty line USAID's strong bilateral position enables it to exert influence at the policy level that will facilitate national and international implementing agencies, NGOs, and local organizations' expansion of IPM adoption

Action Research

The Indonesian experience has demonstrated well that farmers and scientists can interrelate effectively to design and conduct applied research The IPMTP places high priority on farmer research The Action Research Facilities are centers of farmer research activity Community IPM programs include components of farmer research designed to fine tune IPM systems in accordance with local conditions From season to season conditions change and new problems and solutions emerge Thus, there is a continuous need for research as an integral component of IPM systems

Far-sighted research leading to the discovery of scientific advances to cope with fundamental crop management issues is important – more will be said on this topic below However, research that deals with emerging problems is also important The IPMTP has developed an action research program, through training, and an infrastructure, through the ARF network, that enables farmers to take an active role in the research effort The turnaround time for this type of research can be very short For example, an outbreak of white stemborer threatened severe damage in a major West Java rice bowl region in the late 1980s An ARF was set up in the affected area, and a strategy to combat the outbreak – by hand picking egg masses – was tested and implemented, preventing a potential disaster This effort was completed during the course of a single season

Research of this type varies in complexity Certainly there is a need for trained plant scientists and ecologists to provide leadership But, the results of the research are for farmers to use When the action research program involves scientists and farmers as partners, the lag time between discovery and application is substantially shortened

USAID s program in Indonesia has enabled foreign and Indonesian scientists to interact with each other and with Indonesian farmers in research settings at the farm level A number of topics have been addressed, from testing simple crop management options to propagation and application of microbial agents The FAO ICP is replicating the ARF model in other countries beyond Indonesia USAID should support this effort by facilitating the linkage of scientists and action research programs

Scientists with experience in the Indonesian IPMTP understand the importance of working with farmers on problems of immediate concern They have experience setting up and executing successful research programs with farmer cooperators USAID should seek ways to help FAO expand this research approach by providing support for workshops and conferences that emphasize the process, and for implementation of pilot research programs Ultimately, this approach should evolve into a partnership between farmers and research institutes that will require the support of explicit policy that mandates scientist participation USAID's influence in the policy arena should reinforce this approach

Farmer Field Schools

The participatory farmer training approach to farmer IPM training is a major achievement of the USAID experience in Indonesia The success of this approach is demonstrated by the enthusiastic support it receives from its farmer clientele USAID has played an important role in the development of the FFS model that can be exported to other countries

Tangible support for FFSs will be in the form of training materials and personnel To support the IPMTP in Indonesia, IPM scientists have prepared many field exercises for use in training These exercises vary in complexity They are designed to demonstrate fundamental principles of IPM and the ecological relationships among plants and populations of pests and beneficial organisms Especially as FFSs expand to include a wider diversity of crops, such as vegetables, the need for current field exercises will increase Field exercises are important learning tools because they involve farmers in a hands-on approach to understanding crop and pest dynamics Thus, they are elemental to the participatory training approach Developing field exercises is an on-going effort that training programs will always rely upon Sharing field exercises to areas where conditions are appropriate will expand their use and speed the training process

USAID can strengthen FFSs by supporting development and dissemination of training exercises This can be accomplished through support of crop management experts expressly for this purpose, and of workshops and conferences bringing together the scientists and trainers who develop and apply the exercises A large number of exercises are already available that have been developed by the FAO technical

assistance team, WEI, and the Clemson University projects They are available to be shared with other IPM training programs

Perhaps the most efficient means to expand upon the Indonesian experience with IPM is through the international network of IPM training professionals that grows as IPM programs multiply English language communications training is an example of an activity that can have a significant impact on the dissemination of the Indonesian experience FAO undertook an experiment in this vein in 1997 when 10 Indonesian IPM trainers were placed in an intensive English program in Amherst, Massachusetts The six-month program was designed to enable the Indonesian training experts to acquire the communications skills necessary to interact with counterparts in other countries The focus was on verbal presentation By the end of the program they were able to make professional presentations in English and discuss the ramifications of their IPM experiences A second group, including field personnel from Vietnam, Cambodia, China, and Indonesia, has recently begun similar training FAO hopes to develop a network of about 250 IPM training experts representing several Asian countries

USAID is uniquely suited to support this sort of communications training activity As IPM adoption spreads to farmers in developing countries worldwide, this network of international experts will be strained to fulfill the backstopping role that is, and will be, so important USAID has a long history of support for human capital development through training at American institutions Short-term language training would be a relatively low cost means to reinforce the human infrastructure that will be the backbone of IPM programs everywhere Communication between IPM scientists and field practitioners is essential to solidify the place of IPM in the agricultural landscape

Support the NGO network for IPM

NGOs play a strong advocacy role in the adoption process for IPM Due to the public good nature of IPM training, political support is essential before a widespread program will be put in place On a smaller than national scale – at the community or regional level – political support will be easier to muster, and it is at these levels that NGOs are at a particular advantage There are several NGOs with interests in IPM World Education has the experience from working in Indonesia to lead IPM training efforts elsewhere

USAID goals of democratization and environmental management are clearly reflected by providing assistance to NGO efforts in these areas The participatory training model carries a strong democratization theme and sound environmental management is an obvious result of IPM adoption USAID priorities would be well served by facilitating the exposure of NGOs in other countries, or international NGOs with programs in other countries, to Indonesia and the various NGO activities that have taken place there

Grants for extended contacts with the Indonesian program

IPM training as it is conducted in Indonesia emanates from a new view of agricultural development, as discussed above The IPM paradigm is not immediately understood or embraced by policy leaders or program implementers For that reason, it is important for potential IPM advocates from other countries to have a long-term exposure to the functioning of the IPM paradigm so they can carry the correct message back to their homes

An IPM FFS covers a complete growing season The community IPM program design calls for a deliberate process of planning, analysis, priority setting, and political action before implementation of IPM activities is begun The process of IPM program development is an elemental component of the nonlinear paradigm Contrary to the linear devolution of directives from the center to the farm level of traditional government assistance efforts, the IPM model requires considerable time for feedback to develop effective programs In Indonesia the IPMTP demonstrates how this process works Exposure to Indonesia's IPMTP through season-long, or longer, direct contact by IPM experts and field extension workers will enhance the communication of the program's principles and methods to other countries

USAID should explore opportunities to bring foreign training and crop management program leaders to Indonesia for extended contact with the IPMTP This sort of activity is distinct from holding conferences or workshops, and is intended to instill the sense of the process rather than communicate specific program issues

Support regional IPM conferences and workshops

The science of IPM is a dynamic field and many of the crop management issues that IPM scientists confront are important internationally Development of the science of IPM will be enhanced by facilitating interaction among crop scientists Indonesia has dedicated resources to IPM research under the IPMTP and through assistance programs, including USAID's, that reinforce the IPMTP Thus, Indonesia is an excellent focal point for IPM conferencing among regional experts USAID should take advantage of the research capital that has been developed in Indonesia, and of the potential contributions that may come from regional collaborators, by supporting forums that bring them together

The potential payoff from this sort of activity is large Indonesia would benefit from the additional expertise brought to bear on issues concerning Indonesian farmers And, international experts would benefit from learning of research progress made in Indonesia Furthermore, this activity would strengthen the international cadre of IPM scientists who share with farmers the burden of ensuring that evolving farming systems are managed in a sustainable manner

Sustain international collaborations

The Clemson University projects demonstrate that international partnerships provide a basis for high quality support to the IPMTP The resources provided through these research-oriented projects allow scientists to respond effectively to key

problems identified by field IPM support staff Responses can be in the form of field tests of various IPM alternatives, or workshops or other short educational programs to bring field staff up to speed on approaches to new problems Whatever the specific issue or appropriate response, the key is that there is minimum delay between problem identification and response This type of effort is distinct from projects operated through the established research structure Allocation of research funds and priority setting are not constrained by an institutional structure formed in line with the linear paradigm The result of this type of program is a synergistic combination of research talents that bring international experience and local familiarity to bear on critical problems quickly and efficiently

USAID is in a position to facilitate these collaborative efforts by providing financial support to sustained partnerships The UDLP program linking Clemson University and IPB is an excellent example of this type of program Similar linkages are feasible linking IPM scientists regionally where similar problems are common and the need for an infrastructure to combat emerging IPM issues is great

Maintain a regional center for IPM research

Under the Clemson University project an IPM laboratory was established in Bogor at the Research Institute for Food Crops Biotechnology (RIFCB) Renovation of the space and equipment were funded by USAID Before termination of the Clemson project, it was agreed that the laboratory would be maintained and supported by the RIFCB, the IPMTP, and IPB However, due to economic stress in Indonesia that has reduced government budget flexibility, the future of the laboratory is uncertain

Given the USAID investment and the critical mass of expertise located in Bogor, the laboratory would be an ideal setting for a regional IPM research center Bogor is home to the regional office of the International Potato Center (CIP) whose scientists have teamed with Clemson and the IPMTP on several research efforts Several other international agencies maintain facilities in Bogor, including many of the CGIAR system Bogor is easily accessible to Jakarta and frequently entertains visiting scientists from other parts of Indonesia as well as from other countries

USAID support of a regional IPM research center could include funding of an Indonesian IPM scientist and staff to manage and maintain the facility, and visiting scientists from other countries to learn from the Indonesian experience and to expand the scope of IPM knowledge in the region and around the world This center would provide a focal point for IPM research in Southeast Asia Resources managed through the center would support research geared to farmer training in participating countries

A center of this type would be in an ideal position to address emerging issues such as the growing problem of the leaf miner, *Liriomyza huidobrensis*, in Indonesia This has already caused severe damage, and is having an impact on many important vegetable crops in Indonesia It is likely that the same problem will be found in neighboring countries So far, a concentrated effort to develop IPM strategies is lacking Farmers are applying large amounts of chemical pesticides with little effect This type of problem is not unique in the world of dynamic agricultural systems A response mechanism is needed to minimize the harm caused by the new pest Such a

mechanism would take the form of an institutional capacity to monitor pest problems and identify new developments, and then to design and implement an IPM strategy to control the problem

Recognize the role of agriculture, and IPM, in the process of national economic development

The economic and political changes that Indonesia faces in 1998 impact all levels of society Given that 46 percent of the Indonesian workforce is employed in agriculture, programs that affect the agricultural economy will have widespread benefits

IPMTP leaders in West Sumatra have worked with farmer groups in that province to expand access of farmers to biocontrol agents by organizing local distribution centers Through these centers farmers obtain microbial and other biocontrol agents for application primarily in vegetable production areas Efficacy of these agents has been demonstrated by previous field studies, but optimal management systems are still being developed The biocontrols offer a less costly alternative to increasingly expensive chemical pesticides whose imported ingredients are driving prices very high This is an example of a situation where the economic crisis in Indonesia is enhancing the adoption of IPM

The danger of this situation is that technical support for use of biocontrol agents is highly specialized and is not yet generally accessible in Indonesia The FAO and Clemson projects have provided the bulk of this support, but those projects will soon be terminated The IPMTP needs to ensure that technical support to fine-tune existing biocontrol systems, and to press the search for new ones, will be given high priority

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